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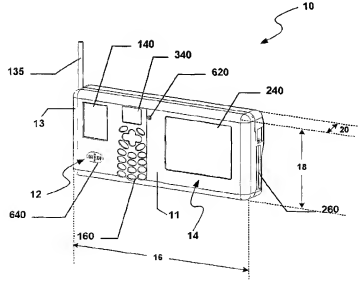
(54) **Title:** PORTABLE NAVIGATION AND COMMUNICATION SYSTEMS



(57) **Abstract:** Disclosed is a portable navigation and communication system. In one embodiment, the system combines within a single enclosure a GPS satellite positioning unit, a means of mobile telephony using cell phone technology and a means of personal computing capable of wired or wireless internet/intranet access using a standard operating system. In one aspect of this embodiment, multiple displays can maintain functional independence of simultaneous operations and allow for fail-over to enhance reliability. Further, a speech recognition subsystem can also be included to provide a voice-activated, speech-controlled user interface for hands-free operation.

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PORTABLE NAVIGATION AND COMMUNICATION SYSTEMS

CROSS-REFERENCE TO RELATED APPLICATIONS

This application claims the benefit of U.S. Provisional Patent Application No. 60/338,399, filed December 7, 2001, entitled "Portable Navigation and Communication System;" and U.S. Provisional Patent Application No. 60/343,367, filed December 21, 2001, entitled "Portable Navigation and Communication System," both of which are incorporated herein in their entireties by reference. Selected portions of U.S. Provisional Patent Application No. 60/338,399 are attached herein as Appendix A and form part of this disclosure.

TECHNICAL FIELD

The following disclosure relates generally to methods and systems for navigation and communication.

BACKGROUND

Prior to the launch of the global positioning satellite (GPS) system, persons traveling on foot or by vehicle were effectively limited in their direction-finding means to a compass. Initially designed by the United States Departments of Defense and Transportation for military use only, the GPS system first became available on a subscription-like basis in 1978. Driven by demands for more accurate navigation, especially among commercial airlines, those restrictions were relaxed during the mid 1980's. That opening of the GPS system occurred as more satellites were launched, enabling greater accuracy for determining location. Good discussions of the workings of a GPS-based navigation system can be found in U.S. Patent No. 5,528,248 and in U.S. Patent No. 5,943,018. In April of 1995 the system, containing 24 operational satellites, was formally declared as having achieved full capability.

Since then, GPS receivers have gone the way of the Personal Computer (PC) before them. The advance of semiconductor technology has enabled more functionality to be offered in ever smaller and more power efficient packages at even lower costs. Formerly limited by size, power and cost constraints to vehicular

mounts for commercial users, GPS receivers have become readily available and increasingly popular as a handheld means of determining location and direction of travel. Widespread use has developed beyond the earlier aviation and emergency services occupations to include people as varied as truck fleet operators, commercial fishermen, farmers and hikers.

Paralleling the development of handheld GPS receivers, but much more apparent to the casual observer, has been the development of the now ubiquitous cellular telephone. Not too many years ago, mobile telephony was restricted to localized operator-assisted paging systems and used primarily by medical personnel and other employees who were "on call"; the carrying of a pager projected an elite status to the one who carried it. In only a few years, cell phones have become so commonplace as to become regarded as a public nuisance, necessitating governmental restrictions as to where and how they may be used. Concerns have arisen over potential health risks related to the power being transmitted from phones held in close proximity to the human ear, and therefore near the brain. Being as yet unproved, the long-term health risks of hand-held cell phone usage have not drawn nearly as much attention as the immediate safety concerns of cell phones being used by operators of moving vehicles. Legislators concerned about traffic safety have banned the use of hand-held cell phones while operating motor vehicles in some states, and many more governmental bodies are considering similar restrictions. Phones offering hands-free operation alleviate most of the problems related to health and safety.

Of course, leading the way in the reduction in size and cost of computing power, the desktop PC has been reduced first to the laptop computer and beyond that to the Personal Digital Assistant (PDA) for handheld personal computing. Initially limited to use as an address book and calendar, the PDA is growing along with other computing devices in its ability to take on more complex tasks. The computer that was confined to the office a few years ago has been put into a coat pocket and taken out onto the street and into the airplane by the business traveler.

Some products have combined the cell phone with a PDA, as in U.S. Patent No. 5,797,089, which gives a good discussion of related prior art and the Motorola Accompli™ series of products, among others. Davis in U.S. Patent No. 5,877,724 has shown the merger of a cell phone with GPS, as also has the Garmin Corporation

in their NavTalk product line. Inventor Miller showed in U.S. Patent No. 5,943,018 one means of attaching a portable GPS receiver unit to the underside of a portable computer.

By 1994, Magneti Marelli, a subsidiary of Italian car manufacturer Fiat, had begun selling its Route Planner™ satellite navigation system, specifically designed for car drivers. Within a few years, General Motors had made their OnStar™ service available to motorists as protection in case their vehicle later became disabled. In 1998 Clarion, collaborating with Microsoft, introduced "AutoPC" with its ability to add accessories to support all of the functions of GPS, cell phone and PC, in addition to the audio entertainment that had become expected by many automobile owners and drivers. U.S. Patent No. 6,374,177 is related to these functions and discusses a system allowing a person to update entertainment selections based on geographic location. A recent report, "Telematics: A Market Study of In-Vehicle Communications, Navigation, and Digital Radio" states that "Although Telematics has begun with operator-based services like those from OnStar™ and ATX, there will be a continual integration of other in-vehicle electronics to encompass entertainment, navigation, and E911 equipment. ... [which] are presently separate electronic systems." In U.S. Patent No. 6,083,353, Alexander remarked, "hardware and software hurdles have limited the ability to utilize multicomponent data gathering systems in the field. Connecting equipment such as a GPS, a two-way radio, and a handheld pen computer for use in the field poses a number of obstacles. Many wires and cables work fine on a desktop computer but not on a handheld device." Further, Thilo Koslowski, lead automotive analyst and research director for the well known Gartner (G2) Group was reported in the October 2, 2002 issue of Wireless NewsFactor as saying, "The results show that the industry is being misled by the idea that they have to push all information systems and replicate the PC experience in a vehicle, which is not a good idea."

BRIEF DESCRIPTION OF THE DRAWINGS

Figure 1 is an isometric view of a Portable Navigation and Communication System (PNCS) configured in accordance with an embodiment of the invention.

Figure 2 is a Functional Block Diagram of a PNCS configured in accordance with an embodiment of the invention.

DETAILED DESCRIPTION

The following description provides specific details for a thorough understanding of, and enabling description for, embodiments of the invention. However, one skilled in the art will understand that the invention may be practiced without these details. In other instances, certain structures and functions have not been shown or described in detail to avoid unnecessarily obscuring the description of the embodiments of the invention.

To achieve a multifunctional combination including a GPS, cell phone and PC, requires overcoming the initial problems of size, cabling and power requirements. Making a device small enough to accomplish the three-way combination in a single package brings into play other technical difficulties. One of these arises when the transmitting antenna of the relatively powerful cell phone is in close proximity to the sensitive GPS receiving antenna. Other considerations involve eliminating external interconnecting cables and providing hands-free and heads-up capability in response to safety and regulatory requirements.

Because of the multifunctional nature of the system and device that embody the present invention, it touches on multiple fields. However, the combined functions that are described here as residing within a single unit contribute synergisms not recognized by devices known in the prior art. Indeed, some industry experts are currently teaching away from the combination of functions even for automotive use.

Furthermore, it is believed that attempts to couple modules to achieve a multifunctional device would likely do so with a mindset toward reduction of manufacturing costs. This expectation is supported by the fact that announced, but yet to be delivered, handheld products are moving toward larger displays in order to offer capability more nearly that which has become expected in the desktop personal computing environment. It stands to reason then that among the first casualties of a multifunctional approach would be a reduction of display components to provide only one common display for all functions and modes. This can be seen in products, such as Garmin's NavTalk II, that purport to offer multifunctionality. They have chosen to consolidate their visual output into a single display, whether for reduction of costs, to accommodate an established form factor, or for some other reason. The present invention suggests that this consolidation of displays is misguided as it

sacrifices ease of use and reliability, if not safety. Contrary to the expected norm, the advantages of multiple displays may offset, and indeed may exceed, the material cost involved.

In one embodiment of the present invention, a personal navigation and communications device includes multiple displays housed in a single enclosure with a personal computing means. In an aspect of this embodiment, the device comprises a satellite positioning unit, a cellular phone as a mobile telephone unit, and a personal digital assistant (PDA) unit. The capability and performance of the satellite positioning unit, implemented in a GPS module, can be enhanced by an electronic compass. Each of the compass, the phone, and the PDA has its own primary display module. The larger display, normally associated with the PDA, can include a touchscreen. An integrated keypad enables manual entry of other data and menu-driven commands. A microphone receives sound which is analyzed by a Speech Recognition Unit to provide an alternate means of data entry in support of hands-free operation. A speaker provides audible output, including synthesized speech as well as a means of delivering audio entertainment. The PDA module can use an industry standard operating system and supports industry standard removable data storage. The PDA can also include network and port connections for access to the Internet, beyond the wireless modem capability attached to the cell phone. An additional special-purpose microprocessor can work in conjunction with the PDA. All functions are electronically interconnected without external cables so as to share memory and displays. The device also includes a power supply to support all functions. An internal battery enables portability and may be assisted by accessory power from an automobile or other vehicle, or by a panel of solar cells through standard external power connectors. Wherever possible, industry standards are maintained through the use of commonly available modules and components.

Embodiments of the present invention provide a device that can improve over the prior art in at least some of the following areas:

(a) it combines all of the functions of a GPS, a cell phone and a PDA into a single portable package small enough that it can be carried in a coat pocket;

(b) it offers ease of use, and improved system reliability, by retaining separate displays for the various functions; and

(c) it increases system reliability by reducing the overall number of components through the sharing of memory, data storage, power supply and other non-display items;

(d) it offers hands-free operation that can alleviate problems related to health and safety; and

(d) it offers a wireless port for additional PC hardware.

By virtue of being portable, a device designed under embodiments of the present invention:

(a) can be mounted in a motorized vehicle whether a car, truck, bus, boat, or airplane;

(b) can be moved from one vehicle to another, say from a weekday commute car to a weekend recreational vehicle;

(c) can be removed from a vehicle that has been sold for continued use in another replacement vehicle;

(d) can be carried from home or car into the high-rise buildings of town center or into remote areas such as the desert or mountains, or taken off-road to waterways such as lakes, rivers, or ocean; and

(e) can be upgraded without requiring modification outside of itself.

Due to the inclusion of multiple displays under control of a common processor having shared memory, a device under embodiments of the present invention:

(a) offers greater ease of use by simultaneously displaying phone information on a smaller display without interfering with mapping, calendar or other information on another larger display;

(b) offers greater ease of use and safety by allowing more comprehensive phone information to be automatically presented on the larger display when that display is not otherwise in use, so as to overcome the need for multiple screens or scrolling on the smaller display;

(c) offers greater reliability by allowing that same phone information to move automatically to the larger display in case of failure of the smaller display which is dedicated to the phone; and

(d) offers increased battery life by being able to selectively power-down unused displays.

Embodiments of the present invention are described below with reference to the accompanying drawings. As noted previously, the devices of this invention are disclosed here with particular reference to a Portable system for Navigation and Communication. While the basic operation will be described in detail, the disclosed system includes allowance for connection through industry standard interfaces to other devices, thereby enabling functionality that will be readily recognized by those skilled in the art though such a detailed description is not given here.

FIG. 1 depicts an isometric view of a Portable Navigation and Communication System (PNCS) 10 configured in accordance with an embodiment of the invention. The following description is best understood by noting the layout of controls, displays and other features on an operational surface or control panel 11 of the PNCS 10. In particular, notice that the control panel 11 is divided into regions according to various functions. A cell phone region 12 with its controls and small graphical display are positioned generally to the left, whereas a PDA region 14 with a larger, touchscreen display 240 is positioned generally to the right. A compass-specific display 340 and a microphone pickup 620 are positioned near the top center on the face of the PNCS 10, to reduce the likelihood of being obscured by an operator's hand. Placement of the PDA on the right facilitates use (with preference given to right-handed people) of the touchscreen 240, without interfering with the less frequently accessed phone controls or display in the cell phone region 12. In other embodiments, alternative layout configurations are possible to meet the needs of specific markets such as environmentally hardened, waterproofed, and/or preference for left-handed operation.

In one aspect of this embodiment, the PNCS 10 can be housed in an enclosure 13 which is easily portable by a person. For example, the enclosure 13 can have a width dimension 16, a height dimension 18, and a thickness dimension 20. In one embodiment, the width dimension 16 can be less than about 10 inches, the height dimension 18 can be less than about 5 inches, and the thickness dimension 20 can be less than about 3 inches. In other embodiments, these dimensions can have other values. For example, in another embodiment, the width dimension 16 can be less than about 9 inches, the height dimension 18 can be less than about 4 inches, and the thickness dimension 20 can be less than about 2 inches. In a further embodiment, the width dimension 16 can be less than about 8.6

inches, the height dimension 18 can be less than about 3.8 inches, and the thickness dimension 20 can be less than about 1.5 inches. In yet another embodiment, the width dimension 16 can be about 8.5 inches, the height dimension 18 can be about 3.75 inches, and the thickness dimension 20 can be about 1.38 inches.

The Functional Block Diagram of FIG. 2 shows one embodiment with one set of compatible options. Other options available for the creation of other embodiments will be described though they are not specifically shown in the figures.

Referring to FIGS. 1 and 2 together, in one aspect of this embodiment, the PNCS 10 is comprised of four subsystems:

(1) Wireless Communication System 100,

(2) Navigation/PDA (Personal Digital Assistant) 200,

(3) Electronic Compass 300, and

(4) Power Supply 500.

The Wireless Communication System 100 can communicate with the outside world through two antennas. It can receive positioning information via a GPS Antenna 130. A Wireless Phone Antenna 135 can operate in both transmitter and receiver modes for the cellular phone circuitry within the Wireless Modem/GPS Receiver 120 module. In one embodiment, the Wireless Modem/GPS Receiver 120 is based upon a unit using the GSM protocol (Motorola G18 with Data and GPS), however, a unit using CDMA or another protocol could be functionally interchanged to address alternate markets. The Wireless Modem/GPS Receiver 120 can interface via bi-directional PIC Serial Data Bus 122 to the process controller, which can be a Programmable Interface Chip (PIC) 400, which can be a RISC-based micro-controller, and through PDA Serial Data Bus 126 to the PDA 220. An Audio Data Bus 124 can connect to the Microphone 620 and to a Speaker 640.

In another aspect of this embodiment, the Phone Display 140 is fed data from a PIC 400 on Phone Display Data Bus 142 in response to data supplied from PIC Serial Data Bus 122. This same path can be used to control the brightness of the Phone Display 140 which is implemented as a monochrome, 64 x 80 pixel, STN (Super Twisted Nematic) display, part number TM86CDC made by Tianma. This display is capable of presenting text and low-resolution graphics. This Phone

Display 140 is used to display standard wireless telephone information including Caller ID, Call Waiting ID and other features that may be available by subscription.

In another aspect of this embodiment, a Keypad 160 connects to the PIC 400 and is associated with telephone functions. In other embodiments, the PIC 400 can be programmed to associate the Keypad 160 with the PDA 220 as well.

A Speech Recognition Processor 180 can be an ISD-SR3000 assisted by W26L010AT Memory from Winbond Electronics Corporation, and can operate in two modes. In both modes the Speech Recognition Processor 180 can be assisted by a CODEC 190 (Coder/Decoder), which can be a Motorola MC145481. In the first mode, it can receive textual data from the PIC 400 via Recognition In/Out Bus 182 and generates voiced responses to be audibly presented to the user via the Audio Data Bus 124. In the second mode, the Speech Recognition Processor 180 can analyze audio content received on the Audio Data Bus 124 and convert it to the equivalent of a textual data stream. The audio output can be amplified to necessary signal levels for the cell phone by an amplifier (not shown) on the output side of the Audio Data Bus 124.

From the Wireless Communication System 100, as represented in FIG. 1 by the Phone Antenna 135 and the Phone Display 140, on the left-hand side, we move to the Navigation/PDA 200, which can be housed on the right-hand side of the enclosure. The most visually prominent portion of this section, and of the product itself, is the Large Color Display 240, which can be made by Sharp as LQ038Q5DR01. This is a color, 320 by 240 by 3, HR-TFT (High Resolution, Thin Film Transistor) display. It is capable of presenting text and high resolution graphics in a full range of 65K colors in response to standard video driver software. The display area is pixel-wise equivalent to ¼-VGA, that is, one-fourth of the image area of a standard full-size PC monitor. The Large Color Display 240 is mounted in conjunction with a Touch Screen 250 (3M Corp. #RES-3.8-FG4) to sense user input, generally by means of a stylus, for the PDA 220. Most input to the PDA 220 comes through the Touch Screen 250 using techniques that are well-known in relation to such components.

The PDA 220 in one embodiment is a SH7727 made by the Logic Product Development Company. It runs the Microsoft Windows CE operating system. The Wireless Modem/GPS Receiver 120, via its PDA Serial Data Bus 126, feeds GPS

information to the PDA 220 for processing. The Large Color Display 240 can be used to display mapping information created by a GPS application running on the PDA 220.

The industry standard interfaces supported by the PDA 220 for a Data Storage Device 260 can include Compact Flash and PCMCIA. Since these provide for removable devices, several options are accommodated based upon preferences of the user. In another instance, it might be preferred to use the PCMCIA connection for a disk-like device. One currently available example of such a device is the DataPlay Disk, similar to a miniature Compact Disc, provided by DataPlay, Incorporated with a capacity of 500MB. Another device that might serve the user well is a 1GB Microdrive from IBM. These provisions for Data Storage Device 260 may be used to store data for maps to be used in conjunction with GPS navigation, to provide music, to update or install newer application programs, or for many other purposes as known to developers and users of personal computing systems.

Other of industry standard interfaces can be supported by the PDA 220 and are related to the Ports and Ethernet 280 block. Standard Serial Ports as well as USB Ports can be accommodated for connection to peripheral devices, such as a printer. A PS/2 Port allows for connection of a standard mouse and keyboard. For access to the Internet or to an intranet, a connection in compliance with the Ethernet protocol, including VOIP, can be supported and browser applications running on the PDA 220 can provide the user interface. Also supported can be a "Bluetooth" 802.11b interface that provides short-range wireless protocol capability to connect with other Bluetooth devices. With the variety of hardware devices available for connection to a computer through these standard interfaces, many configurations are apparent. One use of the PNCS 10 can be as a "wireless bridge" wherein one or more network-capable devices are connected locally, using Ethernet or Bluetooth connections provided by the Ports and Ethernet 280 block, through the PDA 220 and the Wireless Modem/GPS Receiver 120 to the Internet or another remote device.

With its standard operating system, the PDA 220 is capable of running many standard applications. An Address and Phone Book program may be used to select a phone number to be dialed by sending appropriate control signals directly to the Wireless Communication System 100. From the same internal database an address

may also be looked up and provided to a Mapping Program to retrieve a set of directions for traveling to the desired destination. Those directions may be displayed on the Large Color Display 240 as a list or in a map format. In an automotive environment a Radar Detector may be connected to an external port with radar indications shown in a manner similar to the GPS navigation information. In an entertainment mode the Data Storage Device 260 may hold an MP3 or other audio disk for playing music while the Large Color Display 240 shows music descriptions and a virtual Control Panel for the player.

In another aspect of this embodiment, the PDA 220 can be controlled by a master process controller PIC 400 with which process control information is exchanged on the PIC/PDA Serial Data Bus 420. The PIC 400 can be a custom-programmed PIC16C74A RISC-based Programmable Interface Chip from Microchip Technology Inc., which operates as a master dispatcher to handle all data transfers between:

(a) Phone Display 140,
(b) Speech Recognition Processor 180,
(c) Wireless Modem/GPS Receiver 120,
(d) Compass Engine 320, and
(e) Compass Display 340.

Information from these devices that is intended for the Large Color Display 240 is generated by the PIC 400 and transferred over the PIC/PDA Serial Data Bus 420 to the PDA 220 which drives the display 240. Although both the PIC 400 and PDA 220 have their own physical memory, it can be treated logically as shared memory to enable mapping to various functions as needed by the PNCS 10 subsystems and determined by the PIC 400.

Under control of the PIC 400, the Electronic Compass 300 can work in conjunction with the GPS subsystem to provide for determination of direction (heading) when, for instance, the presence of tall buildings interferes with reception from satellites. The Compass Engine 320 of one embodiment is implemented as a program in the PIC 400 microcontroller relying on inputs from a two-axis Model KMZ52 compass module and a single-axis Model KMZ51 compass module, both made by Philips. This yields a three-axis (X, Y, Z) compass that recognizes tilt.

When the PNCS 10 is used in association with a moving object, such as a vehicle or walker, position information may be obtained at intervals so that the direction of travel can be determined. In this manner, the GPS can be used in a compass-like mode to indicate direction of travel. However, when the PNCS 10 is stationary, or traveling at less than about 4 MPH, that method of determining direction by itself may become inaccurate or unavailable. By combining the ever-present heading information from the Compass Engine 320 with the current position from the GPS subsystem, those skilled in the art of navigation will understand that an indication of the direction of travel can be maintained even at low speeds.

It will be appreciated that, with embodiments of the present invention, even when a user is standing still, a heading may be determined by the Compass Engine 320 under control of the PIC 400, and that heading may be utilized to "scroll" the map displayed by the PDA 220 on the Large Color Display 240 in a direction relative to the heading. In all cases the Compass Engine 320 allows the PIC 400 to determine a heading and then to drive the Compass Display 340 to indicate that heading even when a user is standing still.

In one embodiment of the invention, the Speech Recognition Processor 180 with its related components is controlled by the PIC 400 to provide a hands-free, voice-activated, speech-controlled user interface to the PNCS 10. The speech interface mimics input from the Keypad 160 and textual input through the Touch Screen 250. This hands-free interface contributes significantly to ease of use of the system while improving user safety, especially when operating a motor vehicle since the user need not look away from the road. Since the PNCS 10 operates as a speakerphone, it also distances the cell phone antenna from the user's head, thereby alleviating health concerns.

All functions of the PNCS 10 are available under speech control. In a first example, the user may activate a phone call by voicing instructions to dial a phone number. The spoken commands may indicate a phone number directly, or indirectly by reference to a name in an address and phone book stored within the unit and accessed by the PDA 220, or looked up online through the interface to the Internet. The PNCS 10 in a second example assists the user to navigate to a desired destination entirely by voice through processes that are known in the art. In one such process the user requests instructions for travel to a destination, for example,

by speaking, "Guide me to the office." The system would then look up the address of the office, or ask for a street address if it was not previously known. Since the GPS subsystem provides the PNCS 10 with its own location at all times, retrieval of route information from a local database, or from the Internet, can be used with a mapping application running on the PDA 220 to call out the turns to the user who is driving a vehicle. Other speech-controlled applications allow the user to read or write email, and to check or update schedules on a calendar. These and other speech-controlled, voice-response applications have been described in the prior art.

In a further aspect of this embodiment of the invention, in its position of master control, the PIC 400 knows the status of the Large Color Display 240, even though that display is driven by the PDA 220. When the Large Color Display 240 is not being used to display applications running on the PDA 220, the PIC 400 may choose that display, since it is larger, to present information that would normally be sent to the smaller Phone Display 140. The PIC 400 may also send phone information to the Large Color Display 240 in an automatic fail-over mode any time that the Phone Display 140 is detected to be in a Not Ready state, such as due to a failure or any other Busy condition. On the other hand, if only the phone is in use, the PIC may place the PDA 220 and its Large Color Display 240 into standby mode to conserve power when running solely on the internal battery.

Under normal operation when all subsystems are in use, the Phone Display 140 can be dedicated to phone information and the Large Color Display 240 will handle the more complex graphical presentations associated with various applications running on the PDA 220. This provides the user with the ability to view, compose, and send email or to view mapping information related to the GPS, on a larger, easier to view screen, while allowing the phone to be used at the same time.

In its present embodiment of the invention, the PNCS 10 is operational from a mounting on or in the dashboard of a motor vehicle where accessory power may be supplied via standard connectors. Its size, form factor and weight, along with self-contained batteries also allow it to be carried in a coat pocket or as a hand-held device for standalone use away from vehicles or other power sources.

Although the present invention refers specifically to the employment of signals transmitted by the known GPS satellite network, it can be appreciated that if a further satellite network for carrying out the same or similar functions is placed into

orbit around the earth, that signals transmitted by the new network could be similarly employed. In particular, due to the modular construction of embodiments of the invention, it is possible that a module having newer functionality could be plugged into existing units of the present invention and would be supported by an update to the associated application software. Such an update would be available either through the removable mass storage device or as a download using a built-in communication port or from the Internet.

The description of embodiments of the invention is not intended to be exhaustive or to limit the invention to the precise form disclosed. While specific embodiments of, and examples for, the invention are described here for illustrative purposes, various equivalent modifications are possible within the scope of the invention, as those skilled in the relevant arts will recognize. For example, while functions are presented in a given order, alternative embodiments may perform functions in a different order, or functions may be performed substantially concurrently. The teachings of the invention provided here can be applied to other systems, not only the system described here. Those with skills in the related arts will also recognize that the manufacturer's data sheets for the components specifically referenced here will enable such a person to construct systems that are similar to those disclosed here and that the various embodiments described here can be combined to provide further embodiments.

Although specific circuitry is described above, those or ordinary skill in the art will recognize that a micro processor-based system could also be used to where any logical decision are configured in software. Unless the context clearly requires otherwise, throughout the description and the claims, the words "comprise," "comprising," and the like are to be construed in an inclusive sense as opposed to an exclusive or exhaustive sense; that is to say, in the sense of "including, but not limited to." Words using the singular or plural number also include the plural or singular number respectively. Additionally, the words "herein," "above," "below" and words of similar import, when used in this application, shall refer to this application as a whole and not to any particular portions of this application. When the claims use the word "or" in reference to a list of two or more items, that word covers all of the following interpretations of the word: any of the items in the list, all of the items in the list and any combination of the items in the list. All of the above U.S. patents

and applications and other references described above are incorporated herein by reference.

These and other changes can be made to the invention in light of the above detailed description. In general, the terms used in the following claims should not be construed to limit the invention to the specific embodiments disclosed in the specification, unless the above detailed description explicitly defines such terms. Accordingly, the actual scope of the invention encompasses the disclosed embodiments and all equivalent ways of practicing or implementing the invention under the claims.

While certain aspects of the invention are presented below in certain claim forms, the inventors contemplate the various aspects of the invention in any number of claim forms. For example, while only one aspect of the invention is recited as embodied in a computer-readable medium, other aspects may likewise be embodied in a computer-readable medium. Accordingly, the inventors reserve the right to add additional claims after filing the application to pursue such additional claim forms for other aspects of the invention. Further, the invention is not limited, except as by the following claims.

DETAILED DESCRIPTION

The following description provides specific details for a thorough understanding of, and enabling description for, embodiments of the invention. However, one skilled in the art will understand that the invention may be practiced without these details. In other instances, well known structures and functions have not been shown or described in detail to avoid unnecessarily obscuring the description of the embodiments of the invention.

Figure 1 and the following discussion provide a brief, general description of a suitable computing environment in which aspects of the invention can be implemented. Although not required, aspects and embodiments of the invention will be described in the general context of computer-executable instructions, such as routines executed by a general purpose computer, *e.g.*, a server or personal computer. Those skilled in the relevant art will appreciate that the invention can be practiced with other computer system configurations, including Internet appliances, hand-held devices, wearable computers, cellular or mobile phones, multi-processor systems, microprocessor-based or programmable consumer electronics, set-top boxes, network PCs, mini-computers, mainframe computers and the like. The invention can be embodied in a special purpose computer or data processor that is specifically programmed, configured or constructed to perform one or more of the computer-executable instructions explained in detail below. Indeed, the term "computer", as used generally herein, refers to any of the above devices, as well as any data processor.

The invention can also be practiced in distributed computing environments, where tasks or modules are performed by remote processing devices, which are linked through a communications network, such as a Local Area Network ("LAN"), Wide Area Network ("WAN") or the Internet. In a distributed computing environment, program modules or sub-routines may be located in both local and remote memory storage devices. Aspects of the invention described below may be stored or distributed on computer-readable media, including magnetic and optically readable and removable computer discs, stored as firmware in chips (*e.g.*, EEPROM chips), as well as distributed electronically over the Internet or over other networks (including wireless networks). Those skilled in the relevant art will recognize that portions of the invention may reside on a server computer, while corresponding portions reside on a client computer. Data structures and transmission of

data particular to aspects of the invention are also encompassed within the scope of the invention.

Referring to Figure 1, one embodiment of the invention employs a computer 100, such as a personal computer or workstation, having one or more processors 101 coupled to one or more user input devices 102 and data storage devices 104. The computer is also coupled to at least one output device such as a display device 106 and one or more optional additional output devices 108 (*e.g.*, printer, plotter, speakers, tactile or olfactory output devices, etc.). The computer may be coupled to external computers, such as via an optional network connection 110, a wireless transceiver 112, or both.

The input devices 102 may include a keyboard and/or a pointing device such as a mouse. Other input devices are possible such as a microphone, joystick, pen, game pad, scanner, digital camera, video camera, and the like. The data storage devices 104 may include any type of computer-readable media that can store data accessible by the computer 100, such as magnetic hard and floppy disk drives, optical disk drives, magnetic cassettes, tape drives, flash memory cards, digital video disks (DVDs), Bernoulli cartridges, RAMs, ROMs, smart cards, etc. Indeed, any medium for storing or transmitting computer-readable instructions and data may be employed, including a connection port to a network such as a local area network (LAN), wide area network (WAN) or the Internet (not shown in Figure 1).

Aspects of the invention may be practiced in a variety of other computing environments. For example, referring to Figure 2A, a distributed computing environment with a web interface includes one or more user computers 202 in a system 200 are shown, each of which includes a browser program module 204 that permits the computer to access and exchange data with the Internet 206, including web sites within the World Wide Web portion of the Internet. The user computers may include one or more central processing units or other logic-processing circuitry, memory, input devices (*e.g.*, keyboards and pointing devices), output devices (*e.g.*, display devices and printers), and storage devices (*e.g.*, magnetic, fixed and floppy disk drives, and optical disk drives), such as described above with respect to Figure 1. User computers may include other program modules such as an operating system, one or more application programs (*e.g.*, animation or graphics applications, word processing or spread sheet applications), and the like. The user computers 102 include wireless computers, such as mobile phones, personal digital

assistants (PDA's), palm-top computers, etc., which communicate with the Internet via a wireless link.

At least one server computer 208, coupled to the Internet or World Wide Web ("Web") 206, performs much or all of the functions for receiving, routing and storing of electronic messages, such as web pages, audio signals and electronic images, such as vocal audio and animation images. While the Internet is shown, a private network, such as an intranet may likewise be used herein. A database 210, coupled to the server computer, stores much of the web pages and content exchanged between the user computers. The server computer, including the database, may employ security measures to inhibit malicious attacks on the system, and to preserve integrity of the messages and data stored therein (*e.g.*, firewall systems, secure socket layers (SSL) password protection schemes, encryption, and the like).

The server computer 208 includes a server engine 212, a web page management component 214, a content management component 216 and a database management component 218. The server engine performs basic processing and operating system level tasks. The web page management component handles creation and display or routing of web pages. Users may access the server computer by means of a URL associated therewith. The content management component handles most of the functions in the embodiments described herein. The database management component includes storage and retrieval tasks with respect to the database, queries to the database, and storage of data such as animation graphics and audio signals.

Referring to Figure 2B, an alternative embodiment to the system 200 is shown as a system 250. The system 250 is substantially similar to the system 200, but includes more than one web server computer (shown as server computers 1, 2, . . . J). A web load balancing system 252 balances load on the several web server computers. Load balancing is a technique well-known in the art for distributing the processing load between two or more computers, to thereby more efficiently process instructions and route data. Such a load balancer can distribute message traffic, particularly during peak traffic times.

A distributed file system 254 couples the web servers to several databases (shown as databases 1, 2 . . . K). A distributed file system is a type of file system in which the file system itself manages and transparently locates pieces of information (*e.g.*, content

pages) from remote files or databases and distributed files across the network, such as a LAN. The distributed file system also manages read and write functions to the databases.

Figure 3 is a block diagram illustrating a suitable navigation and communication system in one embodiment of the invention. In Figure 3, the navigation and communication system 300 includes a small display 302, a large display 304, a cell phone module 306, an electronic compass 308, an audio output module 310, an input device 312, a data play CD 314, a locator module 316, a processor 318, a database 320, an antenna 322, a pager module 324, a browser module 326, an audio play module 328, a radar detection module 330, and a Bluetooth module 332. The small display 302 may be used to display cell phone information, such as provided by the cell phone module 306, which provides cell phone capability to the navigation and communication system. The large display 304 may be used to display any other visual information, such as mapping information, radar indications, music descriptions, etc. The locator module 316 provides location information to the navigation and communication system, and may use Global Positioning System (GPS) or other location-determining technology. The electronic compass 308 may provide more limited location-determining technology when the locator module 316 may not be used, such as when a user is located in between large buildings that block the GPS signals. An audio play module 328 may play music or other audio information, and one skilled in the art will recognize that any formats may be used (*e.g.*, MP3, CD, WAV files, etc.). An audio output module 310, such as a speaker, may provide the audio output to the user. Users may input information or requests for particular functions through an input device 312, such as a keyboard, touch screen, voice recognition device, etc. A data play CD 314 may be used to play audio data, such as music, or to provide storage for other types of data, such as mapping information, tourist information, etc. Other functionality may be provided by the navigation and communication system, such as from a pager module 324 (which provides paging capability), a radar detection module 330 (which detects radar signals, such as from police radars), and a Bluetooth module 332 (which provides wireless protocol capability with other Bluetooth devices). A database 320 may store mapping information, user information, customization information, advertising material, etc.

Figure 4 is an isometric view of a computer-generated image of a suitable navigation and communication system in a first alternative embodiment. Figure 5 depicts

front, side, and back views of the navigation and communication system of Figure 4. Figure 6 depicts an exploded isometric view of the navigation and communication system of Figure 4. Figures 4-6 provide one physical embodiment of the navigation and communication system. One skilled in the art will recognize that many alternative physical embodiments are possible. Similarly, Figures 7-13 depict various views of the navigation and communication system of Figure 4 and some of its components. One skilled in the art will recognize that other manufacturing techniques, designs, and configurations are possible.

Figures 14-16 depict electric wiring diagrams of a suitable navigation and communication system in one embodiment. These figures only provide one possible electrical wiring configuration, and one skilled in the art will recognize that many alternative configurations are possible.

Figures 17-18 depict suitable display screens of a navigation and communication system in one embodiment. In Figures 17-18, the display screen includes cell phone information (such as caller ID information, call times, and menu and name options), a dataplay indicator for displaying information about information being played (such as music), an electronic compass display, a dialpad to be used with a cell phone or other feature, and a mapping display, which may show the current location of the navigation and communication system superimposed over a map so that the user will be able to quickly determine his or her location.

One skilled in the relevant art will appreciate that the concepts of the invention can be used in various environments other than location based or the Internet. In general, a display description may be in HTML, XML or WAP format, email format or any other format suitable for displaying information (including character/code-based formats, algorithm-based formats (*e.g.*, vector generated), and bitmapped formats). Also, various communication channels, such as local area networks, wide area networks, or point-to-point dial-up connections, may be used instead of the Internet. The system may be conducted within a single computer environment, rather than a client/server environment. Also, the user computers may comprise any combination of hardware or software that interacts with the server computer, such as television-based systems and various other consumer products through which commercial or noncommercial transactions can be

conducted. The various aspects of the invention described herein can be implemented in or for any e-mail environment.

Unless the context clearly requires otherwise, throughout the description and the claims, the words 'comprise', 'comprising', and the like are to be construed in an inclusive sense as opposed to an exclusive or exhaustive sense; that is to say, in the sense of "including, but not limited to". Words using the singular or plural number also include the plural or singular number, respectively. Additionally, the words "herein," "above" and "below" and words of similar import, when used in this application, shall refer to this application as a whole and not to any particular portions of this application. Use of the term "or," as used in this application with respect to a list of two or more items, shall be interpreted to cover any, all or any combination of items in the list.

The description of embodiments of the invention is not intended to be exhaustive or to limit the invention to the precise form disclosed. While specific embodiments of, and examples for, the invention are described herein for illustrative purposes, various equivalent modifications are possible within the scope of the invention, as those skilled in the relevant art will recognize. For example, while functions are presented in a given order, alternative embodiments may perform functions in a different order, or functions may be performed substantially concurrently. The teachings of the invention provided herein can be applied to other systems, not only the system described herein. The various embodiments described herein can be combined to provide further embodiments.

Aspects of the invention can be modified, if necessary, to employ the systems, functions and concepts of the above references and application to provide yet further embodiments of the invention. These and other changes can be made to the invention in light of the detailed description.

In the following pages, a more detailed description of embodiments of the invention is included. One skilled in the art will recognize that many alternative embodiments are possible and within the scope of the invention.

APPENDIX

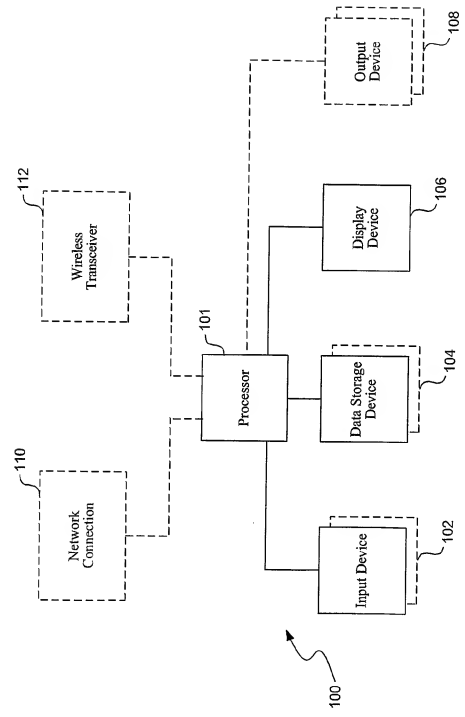

Output Device
108
Wireless Transceiver
112
Display Device
106
Processor
101
Data Storage Device
104
Network Connection
110
Input Device
102
100

Fig. 1

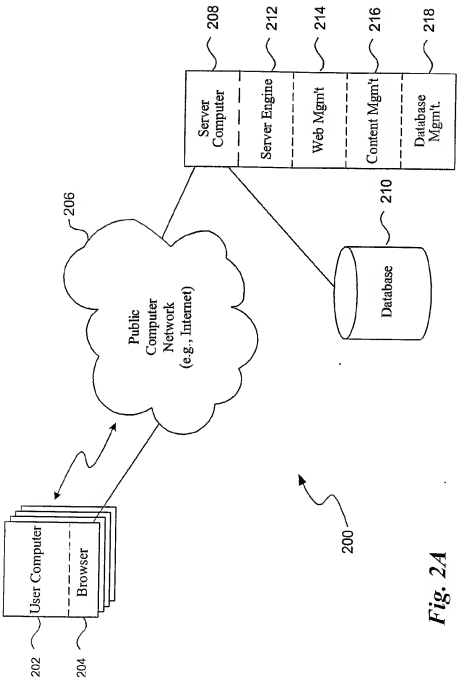

User Computer
Browser
202
204
Public Computer Network (e.g., Internet)
206
Server Computer
Server Engine
Web Mgm't
Content Mgm't
Database Mgm't.
208
212
214
216
218
Database
210
200

Fig. 2A

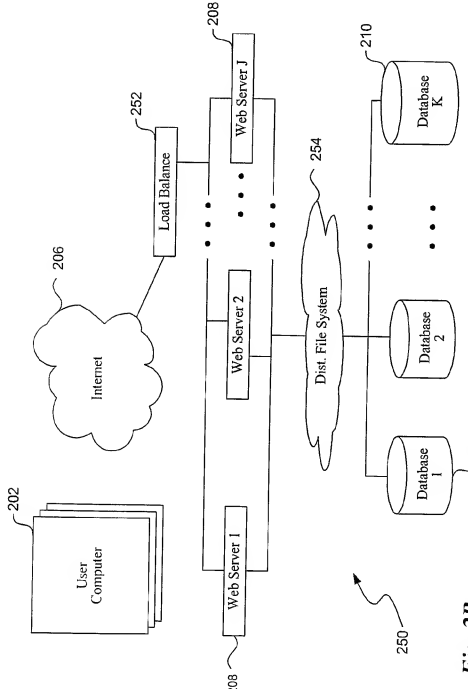

202
User Computer
206
Internet
252
Load Balance
208
Web Server 1
Web Server 2
Web Server J
254
Dist. File System
210
Database 1
Database 2
Database K
250

Fig. 2B

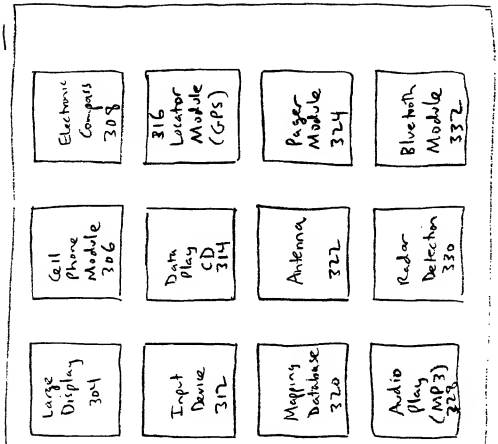


Figure 3

APPENDIX

Figure 5

APPENDIX

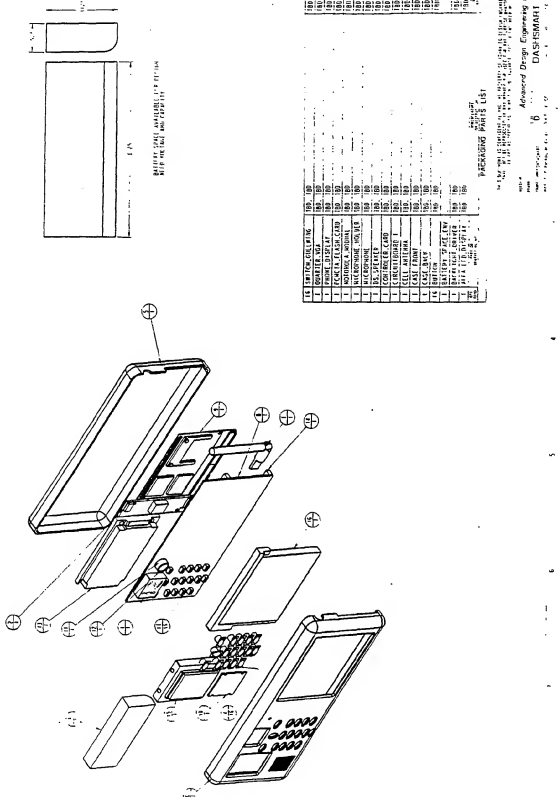
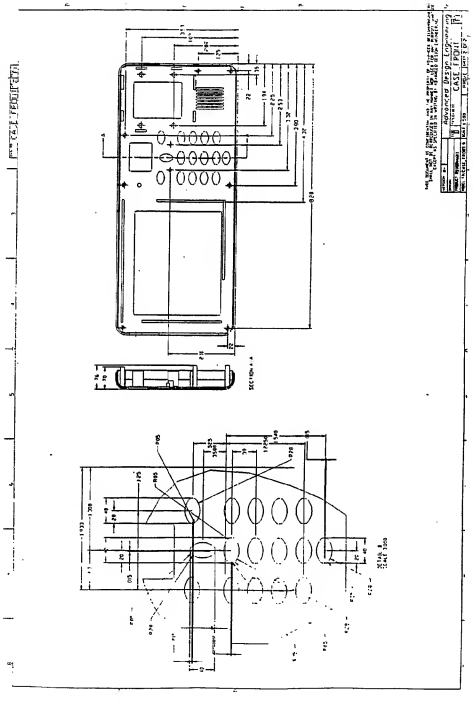


Figure 6

APPENDIX

Figure 9



APPENDIX

CLAIMS

We claim:

1. An apparatus for at least one of communicating, navigating and personal computing, the apparatus comprising:

a single enclosure;

a wireless communication system housed at least partially within the single enclosure, the wireless communication system including at least a Global Positioning Satellite ("GPS") system signal receiver and a wireless telephone signal receiver/transmitter; and

a navigation/Personal Digital Assistant ("PDA") system housed at least partially within the single enclosure, the navigation/PDA system including a PDA display, a first memory device for storing one or more application software programs, a second memory device for storing data, and a processor coupled to the PDA display for performing operations with the data utilizing the one or more application software programs, the navigation/PDA system being configured to receive information from at least one of the GPS receiver and the wireless telephone receiver/transmitter for visual presentation on the PDA display.

2. The apparatus of claim 1, further comprising a compass system housed at least partially within the single enclosure, the compass system including an electronic compass and a compass display operably connected to the electronic compass, the compass display being configured to visually present directional information received from the electronic compass.

3. The apparatus of claim 1, further comprising a compass system housed at least partially within the single enclosure, the compass system including an electronic compass operably connected to the navigation/PDA system, wherein the PDA display is configured to visually present directional information received from the electronic compass.

4. The apparatus of claim 1 wherein the single enclosure has a width dimension of less than about 10 inches, a height dimension of less than about 5 inches, and a thickness dimension of less than about 3 inches.

5. The apparatus of claim 1 wherein the single enclosure has a width dimension of less than about 9 inches, a height dimension of less than about 4 inches, and a thickness dimension of less than about 2 inches.

6. The apparatus of claim 1 wherein the single enclosure has a width dimension of less than about 8.6 inches, a height dimension of less than about 3.8 inches, and a thickness dimension of less than about 1.5 inches.

7. The apparatus of claim 1 wherein the wireless communication system includes a telephone display and a keypad for entering instructions displayable on the telephone display.

8. The apparatus of claim 1 wherein the wireless communication system includes a wireless modem to enable data transmission.

9. The apparatus of claim 1 wherein the wireless communication system includes a wireless modem to enable facsimile data transmission.

10. The apparatus of claim 1 wherein the wireless communication system includes a wireless modem to enable transmission of data conforming to the Short Messaging Service ("SMS") protocol.

11. The apparatus of claim 1 wherein the wireless communication system includes a wireless modem to enable transmission of data conforming to the Multimedia Messaging Service ("MMS") protocol.

12. The apparatus of claim 1 wherein the wireless communication system includes a telephone display configured to visually present information associated with wireless telephone signals, and wherein the apparatus further comprises a

compass system housed at least partially within the single enclosure, the compass system including an electronic compass and a compass display operably connected to the electronic compass, the compass display being configured to visually present directional information received from the electronic compass.

13. The apparatus of claim 1 wherein the wireless communication system includes a telephone display and a keypad for entering instructions and data displayable on the telephone display, and wherein the apparatus further comprises a compass system housed at least partially within the single enclosure, the compass system including an electronic compass and a compass display operably connected to the electronic compass, the compass display being configured to visually present directional information received from the electronic compass.

14. The apparatus of claim 1 wherein the PDA display is further configured to visually present output resulting from execution of the one or more application software programs.

15. The apparatus of claim 1 wherein the PDA display further includes a touch screen for entering data useable by the processor.

16. The apparatus of claim 1, further comprising a controller housed at least partially within the single enclosure and operably connected to the wireless communication system and the navigation/PDA system for controlling the exchange of information between the wireless communication system and the navigation/PDA system.

17. The apparatus of claim 1, further comprising a controller housed at least partially within the single enclosure and operably connected to the wireless communication system and the navigation/PDA system, the controller including a third memory device for storing a set of control software programs for controlling the exchange of information between the wireless communication system and the navigation/PDA system.

18. The apparatus of claim 1, further comprising:

a compass system housed at least partially within the single enclosure, the compass system including an electronic compass and a compass display operably connected to the electronic compass, the compass display being configured to visually present directional information received from the electronic compass; and

a controller housed at least partially within the single enclosure and operably connected to the wireless communication system and the compass system for controlling the exchange of information between the wireless communication system and the compass system.

19. The apparatus of claim 1, further comprising:

a compass system housed at least partially within the single enclosure, the compass system including an electronic compass and a compass display operably connected to the electronic compass, the compass display being configured to visually present directional information received from the electronic compass; and

a controller housed at least partially within the single enclosure and operably connected to the wireless communication system and the compass system for controlling the exchange of information between the wireless communication system and the compass system for determining a heading based at least partially on GPS information received via the wireless commination system.

20. The apparatus of claim 1 wherein the single enclosure includes an attachment portion configured to be releasably attached to an interior portion of a vehicle.

21. The apparatus of claim 1 wherein the single enclosure includes an attachment portion configured to be releasably attached at least proximate to a dashboard of an automobile.

22. The apparatus of claim 1, further comprising a power source for providing power to at least one of the wireless communication system and the navigation/PDA system, wherein the power source includes at least one solar cell.

23. The apparatus of claim 1, further comprising:

a keypad configured to receive input from a user for use by at least one of the wireless communication system and the navigation/PDA system; and

a controller housed at least partially within the single enclosure and operably connected to the keypad, the wireless communication system and the navigation/PDA system for controlling the exchange of information between the keypad, the wireless communication system and the navigation/PDA system.

24. The apparatus of claim 1, further comprising:

a controller housed at least partially within the single enclosure and operably connected to the wireless communication system and the navigation/PDA system for controlling the exchange of information between the wireless communication system and the navigation/PDA system;

an audio receiver positioned at least proximate to an exterior surface of the single enclosure; and

a speech recognition processor housed at least partially within the single enclosure and operably connected to the audio receiver, wherein the speech recognition processor is configured to convert speech received via the audio receiver into digital data, and wherein into the controller is configured to accept the digital data from the speech recognition processor and transmit the digital data to at least one of the wireless communication system and the navigation/PDA system.

25. The apparatus of claim 1, further comprising:

a keypad configured to receive input from a user for use by at least one of the wireless communication system and the navigation/PDA system;

a controller housed at least partially within the single enclosure and operably connected to the keypad, the wireless communication system and the navigation/PDA system for controlling the exchange of information between the keypad, the wireless communication system and the navigation/PDA system;

an audio receiver positioned at least proximate to an exterior surface of the single enclosure; and

a speech recognition processor housed at least partially within the single enclosure and operably connected to the audio receiver, wherein the speech recognition processor is configured to convert speech received via the audio receiver into digital data, and wherein into the controller is configured to accept the digital data from the speech recognition processor and transmit the digital data to at least one of the wireless communication system and the navigation/PDA system in at least generally the same manner as if the digital data had been received from the Keypad.

26. The apparatus of claim 1, further comprising a removable data storage device housed at least partially within the single enclosure, wherein information may be retrieved from and stored to the data storage device in transfers to or from at least one of the first memory device and the second memory device.

27. The apparatus of claim 1 wherein the navigation/PDA system includes an open source operating system.

28. The apparatus of claim 1 wherein the navigation/PDA system includes an industry standard operating system.

29. The apparatus of claim 1 wherein the navigation/PDA system includes a connection port for connection to a computer network.

30. A portable apparatus for wireless communicating, navigating and personal computing, the apparatus comprising:

a single enclosure;

a GPS receiver housed at least partially within the single enclosure;

a key pad positioned at least proximate to an exterior surface of the single enclosure, the key pad configured to receive dialing instructions from a user for a wireless telephone housed at least partially within the single enclosure;

a wireless telephone display positioned at least proximate to the exterior surface of the single enclosure and at least proximate to the key pad, the wireless telephone display configured to display at least a portion of the dialing instructions received via the key pad;

a PDA display positioned least proximate to the exterior surface of the single enclosure and separate from the wireless telephone display, the PDA display configured to display information related to application software programs and information received from at least one of the GPS receiver and the wireless telephone.

31. The apparatus of claim 30 further comprising a compass display positioned at least proximate to the exterior surface of the single enclosure, the compass display configured to display directional information received from an electronic compass housed at least partially within the single enclosure.

32. The apparatus of claim 30 wherein the single enclosure has a width dimension of less than about 10 inches, a height dimension of less than about 5 inches, and a thickness dimension of less than about 3 inches.

33. The apparatus of claim 30 wherein the single enclosure has a width dimension of less than about 9 inches, a height dimension of less than about 4 inches, and a thickness dimension of less than about 2 inches.

34. The apparatus of claim 30 wherein the single enclosure has a width dimension of less than about 8.6 inches, a height dimension of less than about 3.8 inches, and a thickness dimension of less than about 1.5 inches.

35. A portable navigation and communication system comprising:

navigational means for determining at least one of a position and a heading;

telephony means for transmitting and receiving wireless telephone signals containing at least one of audio and digital information;

personal computing means for receiving data from a user and performing operations with the received data utilizing at least one application software program; and

single enclosure means for unitarily housing the navigational means, the telephony means, and the personal computing means.

36. The portable navigation and communication system of claim 35 wherein the telephony means includes a display and a keypad for entering instructions and data displayable on said display

37. The portable navigation and communication system of claim 35 wherein the personal computing means includes a first memory device for storing the at least one application software program, a second memory device for storing at least a portion of the data received from the user, and a processor for performing operations with the portion of the data utilizing the at least one application software program.

38. The portable navigation and communication system of claim 35 wherein the personal computing means includes a display for displaying results from the operations performed with the data received from the user, the display having a touch screen.

39. The portable navigation and communication system of claim 35 further comprising controller means operably connected to the navigational means, the telephony means, and the personal computing means for controlling the exchange of information between at least two of the navigational means, the telephony means, and the personal computing means.

40. The portable navigation and communication system of claim 35 wherein the navigational means include a display and an electronic compass for sensing directional heading data that is displayable on the display.

41. The portable navigation and communication system of claim 35 wherein the telephony means include a cell phone transmitter.

42. The portable navigation and communication system of claim 35 wherein the navigational means include means for receiving information from a satellite.

43. The portable navigation and communication system of claim 35, further comprising power means for providing power to at least one of the navigational means, the telephony means, and the personal computing means, wherein the power means include at least one solar cell.

44. The portable navigation and communication system of claim 35, further comprising:

controller means operably connected to the navigational means, the telephony means, and the personal computing means for controlling the exchange of information between at least two of the navigational means, the telephony means, and the personal computing means; and

a speech recognition means, wherein the controller means are configured to accept data from the speech recognition means and transmit the data to at least one of the navigational means, the telephony means, and the personal computing means.

45. The portable navigation and communication system of claim 35, wherein the personal computing means includes a touch screen for receiving the input from the user.

46. The portable navigation and communication system of claim 35 wherein the personal computing means include means for connection to a computer network.

47. The portable navigation and communication system of claim 35 wherein the enclosing means include means for releasably attaching the portable navigation and communication system to an interior portion of a vehicle.

48. The portable navigation and communication system of claim 35 wherein the enclosing means include means for releasably attaching the portable navigation and communication system at least proximate to a dashboard of an automobile.

49. The portable navigation and communication system of claim 35 wherein the telephony means include means for hands-off use by the user.

50. A portable navigation and communication system within a single enclosure, comprising:

(a) means of position and heading determination including:
a Satellite Positioning System;
a first Display; and
an Electronic Compass for sensing directional heading data that are displayed on said first Display;

(b) mobile telephone means including:
a second Display;
a Keypad for entering instructions and data that are displayed on said second Display; and
a means of transmitting and receiving wireless telephone signals containing audio and data;

(c) means for personal computing including:
a Personal Digital Assistant means
electronically connected to said mobile telephone means,
said Personal Digital Assistant means comprising:

a first memory device for storing a set of application software programs;

a second memory device for storing a set of data; and

a Processor for performing operations with said set of data utilizing

said set of application software programs;

and

a third Display, separate and unique from said second Display, in electrical connection with said Personal Digital Assistant means for display of output produced as a result of said set of application software programs operating on said set of data, said third Display having a Touch Screen;

(d) a Controller means being electrically connected

to said means of position and heading determination,

to said mobile telephone means, and

to said means for personal computing;

and having a third memory device for storing a set of control software programs;

and

(e) a Power Supply for providing electrical power

to said means of position and heading determination,

to said mobile telephone means,

to said personal computing means, and

to said Controller means.

51. The portable navigation and communication system as described in claim 50 wherein said mobile telephone means utilizes cell phone technology.

52. The portable navigation and communication system of claim 50 wherein said Satellite Positioning System utilizes GPS technology and is assisted by said Electronic Compass through operation of said Controller and of said Personal Digital Assistant means.

53. The portable navigation and communication system as described in claim 50 wherein said Power Supply is assisted by an array of solar cells.

54. The portable navigation and communication system as described in claim 50 further comprising a Speech Generator, said Controller means capable of causing said Speech Generator to output the voice equivalent of text prepared for display on any of said first Display, said second Display, or said third Display.

55. The portable navigation and communication system as described in claim 54 further comprising a Speech Recognition Unit, said Controller means capable of accepting data from said Speech Recognition Unit and treating said data from said Speech Recognition Unit as if it had been received from said Keypad or from said Touch Screen.

56. The portable navigation and communication system as described in claim 55 further comprising a removable Data Storage Device having an industry standard interface wherein information may be retrieved from and stored to said Data Storage Device in transfers, respectively, to or from said first memory device, said second memory device, and said third memory device.

57. The portable navigation and communication system as described in claim 56 wherein said means for personal computing is capable of operation with an Open Source operating system.

58. The portable navigation and communication system as described in claim 56 wherein said means for personal computing is capable of operation with an industry standard operating system.

59. The portable navigation and communication system of claim 58 wherein said industry standard operating system is a version of Microsoft Windows CE.

60. The portable navigation and communication system of claim 59 wherein said set of application software programs includes programs that run on all personal computers.

61. The portable navigation and communication system of claim 60 wherein information intended for presentation on said second Display may instead be presented on said third Display if said second Display is in a Not Ready state.

62. The portable navigation and communication system of claim 61 wherein said Personal Digital Assistant means has a connection port to a network.

63. A portable apparatus for wireless data communications, the apparatus comprising:

a single enclosure;

a wireless communication system housed at least partially within the single enclosure, the wireless communication system including at least a wireless telephone signal receiver/transmitter/modem;

a navigation/Personal Digital Assistant (PDA) system housed at least partially within the single enclosure, the navigation/PDA system including a PDA display, a first memory device for storing one or more application software programs, a second memory device for storing data, and a processor coupled to the PDA display for performing operations with the data utilizing the one or more application software programs; and

a connection port for connecting the navigation/PDA system to one or more of a computer, a network bridge, and a network hub.

64. The apparatus of claim 63 wherein the connection port is configured to support industry standard wireless connection protocols.

65. The apparatus of claim 63 wherein the connection port is configured to support an industry standard wireless connection protocol including the "Bluetooth" 802.11b protocol.

66. The apparatus of claim 63 wherein the connection port is configured to support an industry standard wireless connection protocol including Ultra Wideband ("UWB").

67. The apparatus of claim 63 wherein the connection port is configured to support an industry standard connection protocol including the "Ethernet" protocol.

68. The apparatus of claim 63 wherein the connection port is configured to support an industry standard connection protocol including Universal Serial Bus ("USB").

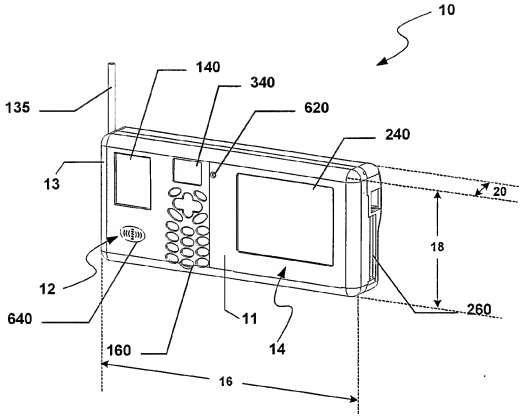


FIG. 1

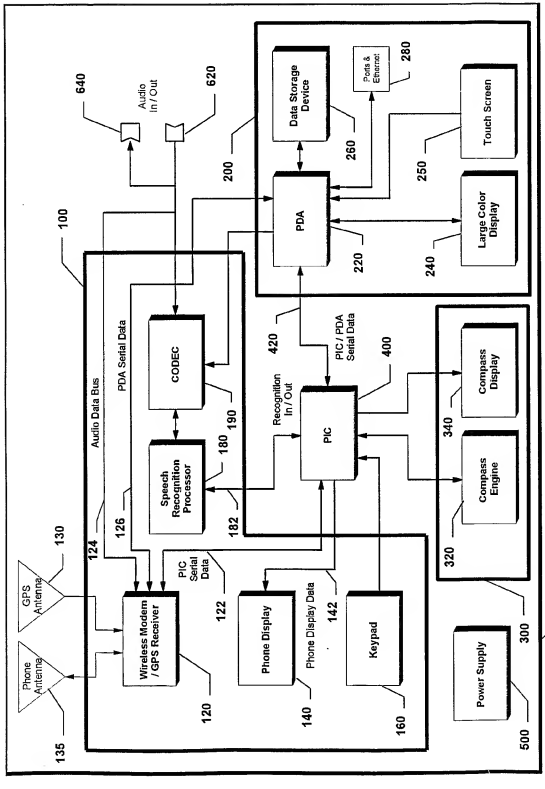

Phone Antenna
135
GPS Antenna
130
124
Audio Data Bus
PDA Serial Data
126
Wireless Modem / GPS Receiver
120
PIC Serial Data
122
Speech Recognition Processor
180
182
CODEC
190
Recognition In / Out
PIC
PIC / PDA Serial Data
420
400
Phone Display
140
Phone Display Data
142
Keypad
160
Power Supply
500
Compass Engine
320
Compass Display
340
300
10
100
640
Audio In / Out
620
200
Data Storage Device
260
PDA
220
Ports & Ethernet
280
Touch Screen
250
Large Color Display
240

FIG. 2